

Remarks

Claims 1-4 and 7 have been amended, and claims 1-11 remain in the application. Reexamination of the application as amended is respectfully requested.

Claims 1-11 are rejected under 35 U.S.C. §102(b) as being anticipated by Smith et al. (U.S. Pat. No. 5,747,102) or Ciardella et al. (U.S. Pat. No. 5,505,777). Smith et al. relates to an apparatus for dispensing small amounts of liquid and viscous materials. Referring to Figs. 1 and 2, an air tube 150 connected to a pressure regulator 152 and a source of low pressure air (not shown) is coupled to the inlet of syringe 12 to force the liquid or viscous material into bore 22 and flow passage 24 about the valve shaft 42 at a constant pressure of about 4 psi to about 30 psi. In the default closed position, as shown in FIGS. 1 and 2, the cup-shaped valve seat component 78 is filled with a small amount of the liquid or viscous material while the valve head 92 is seated against valve seat 38, (col. 10, lines 51-56).

To open the valve, valve shaft 42 is retracted to withdraw valve head 92 from valve seat 38. This step is accomplished by introducing pressurized air from air solenoid 128 into air inlet 124 and then into the air chamber below diaphragm seal 118. The air reacts with the seal 118 to move valve shaft 42 in a direction away from valve seat 38 and towards compression spring 142. During this period of operation, the heated viscous material flows between valve head 92 and the valve seat 38, and into nozzle orifice 100. At the same time, the viscous material located within valve seat component 78 and surrounding valve shaft 42, valve head 92, and valve seat 38 is heated by heating element 50 to a desired temperature. The resulting stream of heated, pressurized viscous material is dispensed through outlet 101 of orifice 100 of nozzle 40 as a thin stream that flows into a string connected to the outlet end 101 of orifice 100, (col. 11, lines 29-44). Thus, material begins to flow through the nozzle upon opening the valve.

The adhesive liquid or viscous material is deformed at a high frequency so that the material acts as a solid for a very brief period of time and then returns to a more fluid state when it breaks away from the outlet end 101 of orifice 100. To accomplish the breaking of the string of liquid or viscous material from orifice 100, air solenoid 128 is turned off, and the spring 142 moves valve 92 against valve seat 38 to close the valve in a very short period of time, (col. 11, lines 45-53). This is a positive displacement step which pushes the heated liquid or viscous material out of the outlet end 101 of orifice 100. The impact force of the closing of valve 92 against valve seat 38 generates a shock wave through the liquid or viscous material which, in combination with the sudden deceleration of the now flowing stream of material, overcomes the yield stress of the liquid or viscous material and breaks the stream of liquid or viscous material dispensed from the outlet end 101 of nozzle 40 to form a droplet of material. The thinner the string of liquid or viscous material formed at the outlet end 101 of orifice 100, the more easily the yield stress is overcome. Note that nozzle 40 is positioned with respect to the valve head 92 so that the bottom surface of valve head 92 is adjacent to tapered inlet 98 of nozzle orifice 100 to minimize the amount of liquid or viscous material which can dissipate the shock wave generated by the closure of valve 92. The droplets of liquid or viscous material from nozzle 40 can be dispensed at a rate of up to 200,000 droplets per hour and typically, up to about 70,000 droplets per hour, (col. 11, line 58 - col. 12, line 11).

In contrast to Smith et al., the invention of independent claims 1, 3 and 4 relates to a jetting process described in paragraph 22 with respect to Fig. 2. The pulsed operation of the transducer 76 ports a pulse of pressurized air into the cylinder 43 and produces a rapid lifting of the piston 41. Lifting the piston lower rod 45 from the seat 49 draws conformal coating material in the chamber 47 to a location between the piston lower rod 45 and the seat 49. [Note, there is no dispensing of material at this point.] At the end of the output pulse, the transducer 76 returns to its original state, thereby releasing the pressurized air in

the cylinder 43, and a return spring 46 rapidly lowers the piston lower rod 45 back against the seat 49. In that process a droplet 37 of conformal coating material is rapidly extruded or jetted through an opening or dispensing orifice 49 of a nozzle 48. As schematically shown in exaggerated form in Fig. 2, a very small conformal coating material droplet 37 breaks away as a result of its own forward momentum and is deposited as a dot of conformal coating material on the substrate 36. Successive operations of the cylinder 43 provide respective droplets of material 37. As used herein, the terms "jetting" refers to the above-described process for forming the conformal coating material droplets 37. The dispenser 40 is capable of jetting droplets from the nozzle 48 at very high rates, for example, up to 100 or more droplets per second.

The "jetting" valve and its associated process is recited in independent claims 1, 3 and 4. Further, operating the jetting valve at 100 times is almost twice the maximum rate of the Smith et al. valve. With the jetting valve open for only 10 milliseconds, the viscous material does not flow through the jetting valve orifice. Applicants submit that Smith et al. does not disclose the jetting valve or process described in paragraph 22 and recited in independent claims 1, 3 and 4; and therefore, Applicants submit that Claims 1-11 are patentable and not anticipated 35 U.S.C. §102(b) by Smith et al.

Ciardella et al. relates to a computer controlled viscous fluid dispensing system. FIGS. 3 and 4 illustrate preferred form of the viscous material dot generator 12 that may be used in the preferred embodiment of our system. A nozzle 70 is rapidly retracted upwardly relative to a fluid feed conduit 72 in order to eject very small droplets or blobs of viscous material at a high velocity from a drop generation chamber 74 inside the nozzle. The nozzle 70 and the fluid feed conduit 72 are both generally cylindrical. The inner diameter of the drop generation chamber 74 is slightly larger than the outer diameter of the fluid feed conduit 72 so that the former can reciprocate relative to the latter. An elastometric cylindrical sealing gasket 76 which surrounds the lower portion of the fluid feed conduit 72 forms a seal between conduit 72 and nozzle 70, while

allowing relative reciprocating motion between them. Upward reciprocation of nozzle 70 relative to the lower portion of the fluid feed conduit 72 forces the lower end of the feed conduit 72 into the drop generation chamber 74. The lower end of the fluid feed conduit 72 thus acts as a plunger or generation chamber 74. This forces a minute quantity of viscous fluid from the drop generation chamber 74 through an exit orifice 78 at a high velocity, (col. 8, lines 16-36).

Independent claims 1, 3 and 4 recite a "jetting" valve having a valve closure element and a valve seat. Causing the valve closure element to engage the valve seat propels a flow of conformal coating material through the nozzle. Applicants submit that Ciardella et al. does not disclose the structure or operation of a jetting valve and its valve closure element and a valve seat of a jetting valve as is recited in independent claims 1, 3 and 4; and therefore, Applicants submit that Claims 1-11 are patentable and not anticipated 35 U.S.C. §102(b) by Ciardella et al.

Claims 1-11 are rejected under 35 U.S.C. §103(a) as being unpatentable over Smith et al. (U.S. Pat. No. 5,747,102) or Ciardella et al. (U.S. Pat. No. 5,505,777) in view of Hynes et al. (6,447,847).

Smith et al. and Ciardella et al. have been previously discussed. Hynes et al. relates to a system having a multi-axes positioning system that supports and moves multiple conformal coating applicators that may be moved to tilted orientations with respect to a substrate. The conformal coating is dispensed using a dispensing valve or a spray valve. Spray valve 32 is a pneumatically actuated valve that combines conformal coating with pressurized air to dispense an atomized spray pattern, such as, for example, a round spray pattern. Dispensing valve 34, also referred to as a "needle valve," is also a pneumatically actuated valve, but flows conformal coating through an interchangeable needle orifice, col. 2, lines 56-63.

In view of the prior discussion of Smith et al. and Ciardella et al., Applicants submit that the combination of either of them with Hynes et al. does not disclose the structure or operation of a jetting valve and its valve closure element and valve seat as is recited in independent claims 1, 3 and 4. Therefore, Applicants submit that Claims 1-11 are patentable and not obvious under 35 U.S.C. §103(a) over Smith et al. or Ciardella et al. in view of Hynes et al.

Applicants submit that the application is now in condition for allowance. The Examiner is invited to contact the undersigned in order to resolve any outstanding issues and expedite the allowance of this application.

Applicant does not believe that any fees are due in connection with this submission. However, if such petition is due or any fees are necessary, the commissioner may consider this to be a request for such and charge any necessary fees to Deposit Account No. 23-3000.

Respectfully submitted,
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